

Form ESA-B4. Public Report for ESA-201-3
FINAL

Company	USG Interiors	ESA Dates	November 11 – 13, 2008
Plant	Greenville	ESA Type	Process Heating
Product	Ceiling Tile	ESA Specialist	Ed Hardison

Brief Narrative Summary Report for the Energy Savings Assessment:

Introduction: An ESA was conducted at the USG Interiors Plant in Greenville, Mississippi, November 11th – 13th, 2008. This plant manufactures ceiling tile. Volcanic mineral is processed in natural gas fired expander which readies the material to be mixed with other materials and water to form slurry that is dried in a kiln. The tiles are coated with various coatings that are dried in low temperature ovens.

Objective of ESA:

1. Introduce the DOE Save Energy Now program and resources available through DOE
2. Provide training on DOE Process Heating Assessment Survey Tool (PHAST)
3. Conduct an energy assessment of selected process heaters
4. Brainstorm potential energy savings opportunities and calculate estimated savings with PHAST

Focus of Assessment: Kiln, Expander, Paint Drying Furnace #1, Paint Drying Furnace #2

Approach for ESA: Review plant equipment and processes, identify target, define data collection strategy and collect data relative to energy use and losses, input data into PHAST software, review data for potential energy savings opportunities, modify conditions based on plant personnel input, identify savings associated with modifications, discuss opportunities and report.

General Observations of Potential Opportunities:

Paint Drying Furnace #1

Reduce/eliminate openings –Paint Drying Furnace #1 dries the coating on the ceiling tile. A chain driven conveyor moves the tile from the coating machine through the drier down the line for stacking and packaging. The conveyor is several feet longer than the oven on each end and loses a significant amount of heat as it exits the oven and is exposed to room temperature air before it re-enters the oven. Measurements indicate approximately a 10°F temperature decrease from the time it exits the oven until it re-enters the oven. This is heat that is lost by the conveyor to the room atmosphere. PHAST indicates an energy loss of 2,012,067 Btu/hr. If the temperature drop is reduced to 5°F by partially enclosing the conveyor at each end PHAST estimates a savings of 6,036 MMBtu/yr. This is a near term opportunity as extending the oven and closing it in more completely would be a relatively straightforward project.

Use of flue gas heat for combustion air preheating – The exhaust for this oven was measured to be 605°F. The exhaust duct is very close to the combustion air duct. It could very easily accommodate a redesign to include a heat exchanger for preheating combustion air. PHAST estimates an energy savings of 32,274 MMBtu/yr if the combustion air is preheated to 250°F. This is also a near term opportunity as the close proximity of the combustion air and exhaust air ducts make installation of a heat exchanger a very viable proposition.

Reduce oxygen content of exhaust gases – Measurements indicated an oxygen level of 17.9% in the exhaust gases. Rather than due to inefficient combustion, the excess oxygen is probably a result of additional air that is pumped into the furnace to cool the conveyor chain. This air is added with the same fan that provides combustion air. If the excess air could be reduced to 12% by replacing the chain with a more heat tolerant material so the cooling air could be reduced, PHAST estimates a savings of 43,356 MMBtu/yr. This is a medium term opportunity as further engineering analysis would be necessary to determine the exact source of the excess air and the associated control necessary to reduce it.

Expander

Use of flue gas heat for combustion air preheating – The expander already incorporates a return duct from the exhaust stack for combustion air. This duct heats the combustion air to approximately 300°F prior to entering the combustion chamber. Ambient make up air is drawn into the exhaust stack through an opening around the duct just above the expander. If the ambient air were preheated by the exhaust gases to 200°F, PHAST estimates an energy savings of 2,461 MMBtu/yr. This is a medium term opportunity as some engineering would be required to set up a system for preheating the air.

Paint Drying Furnace #2 Oven

Reduce oxygen content of exhaust gases – The oxygen level in the stack gas was measured to be 18%. As with Paint Drying Furnace #1 the elevated oxygen level is probably due to infiltration air as opposed to excess air associated with combustion. PHAST indicates if the excess air could be reduced to 12%, the energy savings would be 684 MMBtu/yr. This is a medium term opportunity for, as with the Paint Drying Furnace #1 furnace, further engineering analysis would be necessary to determine the exact source of the excess air and the associated control necessary to reduce it.

Kiln

Calculations associated with the kiln have a higher level of uncertainty as compared to the calculations associated with the other furnaces. The uncertainty arises because the energy utilized by the kiln, as documented by the fuel usage does not balance the energy lost and used by the furnace within a reasonable percent of unbalance. According to PHAST calculations the furnace is losing/using almost 18% more energy than being supplied by the fuel. Multiple efforts of data checking by several personnel could not disclose the apparent discrepancy. However, while there is a level of uncertainty associated with the actual numbers, they nevertheless reveal an approximate magnitude of potential savings opportunities. Those opportunities are discussed here:

Other – Reduce water content of slurry prior to heating in kiln: The slurry goes through a de-watering process prior to entering the kiln. Removing more water would utilize much less energy than heating the slurry in the kiln. If the water content could be reduced an additional 20 points, PHAST estimates an energy savings of 137,958 MMBtu/yr. This is a long term opportunity as additional engineering analysis as well as possible investigation into new technology would be required to determine the feasibility of this or other technology.

Use of flue gas heat for combustion air preheating – Preheating the combustion air to 150°F with heat from the exhaust gas will result in a PHAST estimated energy savings of 37,110 MMBtu/yr. This is a medium term opportunity because of the engineering that would be required to design and install a heat recovery system.

Reduce oxygen content of exhaust gases – As with Paint Drying Furnace #1 and Paint Drying Furnace #2 the oxygen content of the exhaust gases is high (15%) probably due to air infiltration as much as proper air to fuel ratio. PHAST estimates that if the oxygen content is reduced from 15% to 12% an energy savings of 40,356 MMBtu/yr would be realized. This is a medium term opportunity for, as with Paint Drying Furnace #1 and Paint Drying Furnace #2, further engineering analysis would be necessary to determine the exact source of the excess air and the associated control necessary to reduce it.

Near Term, Medium Term, and Long Term opportunities are defined as follows:

- ❑ Near term opportunities would include actions that could be taken as improvements in operating practices, maintenance of equipment or relatively low cost actions or equipment purchases.
- ❑ Medium term opportunities would require purchase of additional equipment and/or changes in the system such as addition of recuperative air preheaters and use of energy to substitute current practices of steam use etc. It would be necessary to carry out further engineering and return on investment analysis.

- ❑ Long term opportunities would require testing of new technology and confirmation of performance of these technologies under the plant operating conditions with economic justification to meet the corporate investment criteria.

Near term opportunities would result in a savings of 3.7% of the total natural gas consumption. Medium term opportunities would result in a savings of 11.9% of the natural gas consumption. Long term opportunities would result in a savings of 13.2% of the natural gas consumption.

Management Support and Comments: Management very supportive of the assessment and the software. The Plant has three individuals that have attended the PHAST training. They intend to use it to help with analyzing savings opportunities.

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